EPA Region 6 Announces Proposed Plan

San Jacinto River Waste Pits Site
Harris County, Texas
August 2016

The Purpose of this Proposed Plan is to:

- Identify the United States Environmental Protection Agency's (EPA's) preferred remedial alternative to address risks associated with contaminants in fish, sediment, and soil at the San Jacinto River Waste Pits Site;
- Provide the results of the Remedial Investigation and Risk Assessments;
- Describe the remedial alternatives evaluated in the Feasibility Study Report;
- Solicit public review and comment on the remedial alternatives and information contained in the Administrative Record file; and
- Provide information on how the public can be involved in the remedy selection process.

In this Proposed Plan, the EPA presents a summary of the risks associated with the release of hazardous substances at the San Jacinto River Waste Pits Site (hereinafter the "Site"), a summary of remedial alternatives, and the preferred alternative to address the contamination at the Site.

The Site, located in Harris County, Texas (Figure 1), consists of a set of impoundments built in the mid-1960s for the disposal of solid and liquid pulp and paper mill wastes, and the surrounding areas containing sediments and soils impacted by waste materials disposed in the impoundments. The northern set of impoundments, approximately 14 acres in size, are located on the western bank of the San Jacinto River, north of the Interstate-10 (I-10) Bridge over the San Jacinto River (Figure 2). These northern impoundments are partially submerged in the river. The southern impoundment, less than 20 acres in size, is located on a small peninsula that extends south of I-10. The wastes that were deposited in the impoundments are contaminated with polychlorinated dibenzo-p-dioxins (dioxins) and polychlorinated dibenzofurans (furans). The Preferred Remedy for cleaning up the Site is Alternative 6N (Full Removal of Materials Exceeding Cleanup Levels, Institutional Controls, and Monitored Natural Recovery) for the northern impoundments and aquatic area, and Alternative 4S (Removal and Offsite Disposal) for the southern impoundment.

The EPA is issuing this Proposed Plan to solicit public comment on the remedial alternatives. This Proposed Plan is being issued in accordance with and as part of its public participation responsibilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) §117(a), 42 U.S.C. § 9617(a) and 40 CFR §300.430(f)(2). The recommendations and alternatives set forth in this Proposed Plan are based on information and documents contained in the Administrative Record file for the Site. EPA will select a final remedy for the Site after the public comment period has ended and the comments have been reviewed and carefully considered. EPA may select a different alternative or a modified version of the Preferred Remedy based on new information or public comments.

The EPA Region 6 office is the lead agency for this Site. The Texas Commission on Environmental Quality (TCEQ) is the support agency.

Community Participation

This Proposed Plan highlights information contained in the Administrative Record for the Site. The Administrative Record includes the Remedial Investigation (RI) Report, risk assessment reports, the Feasibility Study (FS) Report, and other documents and reports used in the preparation of this Proposed Plan.

The EPA encourages the public to review these documents to obtain more information about the Superfund activities that have been conducted. The EPA also encourages the public to participate in the decision-making process for the Site.

The Administrative Record file, along with the Site's profile page, is available on the internet at the following website:

How to Submit Public Comment

EPA will accept written comments on the Proposed Plan during the public comment period. **A 30-day public comment period** on this Proposed Plan and the information contained in the Administrative Record file **begins on July X, 2016 and closes on August X, 2016**. Written comments postmarked no later than August X, 2016 should be sent to:

Gary Miller
EPA Remedial Project Manager
EPA Region 6 (6SF-RA)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202
(214)-665-8318; miller.garyg@epa.gov

If requested, EPA may extend the comment period. Any request for an extension must be made in writing and received no later than August X, 2016.

https://www.epa.gov/tx/san-jacinto-river-waste-pits-superfund-site

The Administrative Record file is also available at the following information repository locations:

Highlands Public Library
Stratford Branch Library
509 Stratford Street
Highlands, Texas 77562
(281) 426-3521

U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue, Suite 700
Dallas, Texas 75202
(800) 533-3508

Texas Commission on Environmental Quality
Building E, Records Management
12100 Park 35 Circle
Austin, Texas 78753
(800) 633-9363

The EPA will hold a public meeting to inform residents of the proposed remedy and obtain comments on the Proposed Plan. The public meeting will be held:

Day, August X, 2016 from X:XX to X:XX PM
LOCATION
ADDRESS

The public meeting is being held in a fully accessible facility. Should you have questions about this facility's compliance with the Americans with Disabilities Act, please contact the EPA Community Involvement

EPA Community Involvement Coordinator
Donn Walters
EPA Region 6 (6SF)
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202
(214) 665-6483; walters.donn@epa.gov

TCEQ Project Manager
Satya Dwivedula
TCEQ Remediation Division (MC-136)
12100 Park 35 Circle
Austin, Texas 78753
(512) 239-3548; satya.dwivedula@tceq.texas.gov

Coordinator (contact information provided below). For specific information about the TCEQ's participation in the Superfund process, please contact the TCEQ Project Manager (contact information provided below).

Site Background

> **Contaminated Media**
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> Improper disposal of paper mill wastes have resulted in contaminated sediment, soil, and fish.
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> **National Priorities Listing**
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> The site was proposed for listing on the National Priorities List on 19 September 2007, and was placed on the list effective 19 March 2008 (73 FR 14723).

In the 1960s, McGinnes Industrial Management Corporation transported liquid and solid pulp and paper mill wastes by barge from the Champion Papers, Inc. paper mill in Pasadena, Texas to impoundments located north of I-10, adjacent to the San Jacinto River, where the waste was stabilized and disposed. Champion Papers, Inc. business records indicate the paper mill produced pulp and paper using chlorine as a bleaching agent. The pulp bleaching process forms dioxins and furans as by-products. The northern impoundments were used for waste disposal from September 1965 to May 1966. Details regarding the southern impoundment are less well known; however, the impoundment was likely constructed sometime between 1962 and 1964 based on evidence of berms visible in historical photos. Sand mining also occurred in the vicinity of the Site.

Early Investigations

Between 1993 and 1995, the City of Houston conducted a toxicity study of the Houston Ship Channel that included the San Jacinto River. Sediment, fish, and crab samples collected near the Site indicated elevated dioxin and furan levels.

Between 2002 and 2004, the TCEQ conducted a study of total maximum daily loads (TMDL) for dioxins and furans in the Houston Ship Channel. Sediment, fish, and crab samples indicated the presence of dioxin and furan contamination in the San Jacinto River surrounding the Site. Results indicated standards were exceeded in 97 percent of fish samples and 95 percent of crab samples. A sediment sample with 19,117 nanograms per kilogram (ng/kg) organic carbon normalized 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxicity equivalent quotient calculated using toxicity equivalent factors for mammals ($TEQ_{DF,M}$) was collected during the study.

In April 2005, the Texas Parks and Wildlife Department sent a letter notifying TCEQ of the existence of former waste pits in a sandbar in the San Jacinto River north of I-10. The letter included: 1) discussion of anecdotal evidence, that indicated the pits were likely used from the mid-1960's to mid-1970's for disposal of paper mill waste; 2) data collected during the Houston Ship Channel Toxicity Study and TMDL study, discussed in the paragraph above; 3) documentation of U.S. Army Corps of Engineers (USACE) dredge and fill permits in the area; and 4) requested that TCEQ further investigate the Site.
A preliminary assessment and screening site inspection was conducted between 2005 and 2006 to determine if the Site was eligible for proposal to the National Priorities List. Sediment sample results indicated elevated concentrations of dioxin congeners. The former surface impoundments were identified as the source of hazardous substances at the Site. Following this assessment and inspection, the Site was added to the National Priorities List.

Unilateral Administrative Order for Remedial Investigation/Feasibility Study

On 20 November 2009, the EPA issued a Unilateral Administrative Order (UAO) to International Paper Company and McGinnes Industrial Management Corporation. International Paper Company is the successor to Champion Papers, Inc. Champion Papers, Inc. had arranged for the disposal or treatment of materials containing hazardous substances that were disposed of at the Site. McGinnes Industrial Maintenance Corporation operated the waste disposal facility at the time of disposal of hazardous substances. The UAO directed International Paper Company and McGinnes Industrial Management Corporation to conduct a RI/FS in accordance with provisions of the order, CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and EPA guidance.

Between 2010 and 2013, site-specific data were collected for the RI. The RI included the collection of paper mill waste, sediment, tissue (i.e., hardhead catfish, Gulf killifish, rangia clam, and blue crabs), soil, and groundwater samples for analyses including dioxins and furans, polychlorinated biphenyls (PCBs) as Aroclors, metals, semivolatile organic compounds, volatile organic compounds, and pesticides. Physical data collected during the RI included: a bathymetric survey, current velocity, material, geotechnical, riverbed properties, sediment loading, erosion rates of cohesive sediment, and net sedimentation rates.

Administrative Settlement Agreement and Order on Consent for Removal Action

On 11 May 2010, EPA filed the Administrative Settlement Agreement and Order on Consent for Removal Action, which was entered into voluntarily by the EPA, International Paper Company, and McGinnes Industrial Management Corporation. The Administrative Settlement Agreement and Order on Consent for Removal Action provided for the performance of a removal action (Time Critical Removal Action [TCRA]).

The EPA Action Memorandum required that the TCRA stabilize the northern impoundments to withstand forces sustained by the river, including a cover design that considered storm events with a return period of 100 years, and prevent direct human and benthic organism contact with waste materials. Elements of the selected TCRA included construction of a perimeter fence on the uplands to prevent unauthorized access; placement of warning signs around the perimeter of the northern impoundments and on the perimeter fence; design and implementation of an operations, monitoring, and maintenance plan; and installation of an armored cap with the following items:

- A stabilizing geotextile underlayment over the northern impoundment eastern cell
- Treatment through stabilization and solidification of a portion of the northern impoundment western cell
- An impervious geomembrane underlayment in the northern impoundment western cell
- A granular cover over the northwestern area of the northern impoundment western cell
- A granular cover above the geotextile and geomembrane in the northern impoundment western cell
- A granular cover above the geotextile in the northern impoundment eastern cell.

TCRA Armored Cap

Since its completion in July 2011, the armored cap has generally isolated and contained impacted material. The following cap deficiencies have been documented since the time of armored cap installation:

- **July 2012:** Approximately 200 square feet (ft^2) of geotextile exposed (armor materials had moved down slope)
- **January 2013:** Five areas deficient in cap thickness and/or have exposed geotextile
- **December 2016:** Approximately 550 ft^2 of cap missing or deficient in cover (no geotextile, paper mill waste exposed to the river, and a sediment concentration measured at 43,700 ng/kg $TEQ_{DF,M}$)
- **February 2016:** portions of eastern cell exposed (five areas, approximately 3 ft^2 each, of exposed geotextile)
- **March 2016:** additional portions of eastern cell deficient in armor cover thickness.

From December 2010 through July 2011, TCRA construction activities were completed at the Site.

General Area of the Time Critical Removal Action

Modified from: Integral Consulting Inc. and Anchor QEA, LLC. 2013. Remedial Investigation Report, San Jacinto River Waste Pits Superfund Site. Prepared for: McGinnes Industrial Maintenance Corporation, International Paper Company, and U.S. Environmental Protection Agency, Region 6. May.

The Operations, Monitoring, and Maintenance Plan identifies continuing obligations, including monitoring and maintenance, with respect to the TCRA. TCRA inspection events include: 1) visual inspection of the security fence, signage and the armored cap, 2) collection of topographic survey data for the portions of the armored cap that are located above the water surface, 3) collection of bathymetric survey data for the portions of the armored cap that are below the water surface, and 4) manual probing of armored cap thickness at areas identified by the topographic or bathymetry surveys as more than 6 inches lower in elevation than during the prior survey. Inspection and repair reports, as needed, are submitted to EPA. The Operation, Monitoring, and Maintenance Plan has been modified because the regular previous inspections failed to identify deficiencies in the cap.

Site Characteristics

The site is located in the estuarine portion of the lower San Jacinto River where the river begins to transition from a fluvial system to a deltaic plain.

Tropical weather systems in the region can have tremendous impacts on regional precipitation and hydrology along the Gulf Coast. Heavy precipitation events produce wide variations in the volume of

Public Participation Activities

EPA in cooperation with Elected Officials, and State, County, and Local Agencies have been providing a steady program of community outreach and public participation for the Site since the Site was listed to the National Priorities List. EPA and the State first met with area agencies such as the Houston-Galveston Area Council to update plans for Site cleanup under the Superfund Program.

EPA and its partner agencies such as Harris County have provided a robust and comprehensive program of community involvement and public participation for the Site. They started with a Community Meeting in 2010 to brief the public regarding the Site and share information on the Superfund process, the next steps, and how the community could get involved in this very technical remediation. As a result of intensive community interest, the Site was deemed a Community Engagement Initiative Site by EPA Headquarters, which led to additional outreach planning such as informational meetings and mail outs to a large site mailing list.

Starting in late 2010, the EPA initiated a Community Advisory Group for the Site known as the Community Awareness Committee which began a series of quarterly meetings at the Harris County Attorney's Office. In 2012, the EPA provided a Technical Assistance Grant to the Galveston Bay Foundation to hire a technical advisor to provide assistance. And, a number of local internet websites are being utilized to keep area citizens updated on site events.

EPA has since provided a number of Community Meetings, Open Houses, Elected Officials briefings, media interviews, Public Notices, and fact sheets to inform the public and keep residents updated on all Site developments that affect cleanup actions. Site fact sheets are available on the Site profile webpage identified on page 2.

Tropical Storms and Hurricanes

Between 1851 and 2004, 25 hurricanes have made landfall along the north Texas Gulf Coast, seven of which were major (Category 3 to 5) storms. Tropical Storm Allison, which hit the Texas Gulf Coast in June 2001, resulted in 5-day and 24-hour rainfall totals of 20 and 13 inches, respectively, in the Houston area, resulting in significant flooding. More recently, Hurricane Rita made landfall in September 2005 as a Category 3 storm with winds at 115 miles per hour. The storm surge caused extensive damage along the Louisiana and extreme southeastern Texas coasts. In September 2008, the eye of Hurricane Ike made landfall at the east end of Galveston Island. Ike made its landfall as a strong Category 2 hurricane, with Category 5-equivalent storm surge, and hurricane-force winds that extended 120 miles from the storm's center.

In October 1994, heavy rainfall occurred in southeast Texas resulting in the San Jacinto River Basin receiving 15 to 20 inches of rain during a week-long period. One of the largest measurements of stream flow ever obtained in Texas, 356,000 cubic feet per second (cfs), was made on the San Jacinto River near Sheldon on 19 October 1994 at a stage of 27 feet. During the measurement, velocities of water that exceeded 15 feet per second (about 10 miles per hour) were observed. Another storm occurring in 1940 had a river stage height of 31.5 feet at the same Sheldon location. The 100-year flood, which is defined as the peak stream flow having a one percent chance of being equaled or exceeded in any given year, was exceeded at 18 of 43 stations monitoring the area. For those stations where the 100-year-flood was exceeded, the flood was from 1.1 to 2.9 times the 100-year-flood.

The 1994 flooding caused major soil erosion and created water channels outside of the San Jacinto River bed. This flooding caused eight pipelines to rupture and 29 others were undermined at river crossings and in new channels created in the flood plain outside of the San Jacinto River boundaries. The largest new channel was cut through the Banana Bend oxbow just west of the Rio Villa Park subdivision, about 2½ miles northwest of the Site. This new channel was approximately 510-feet wide and 15-feet deep. A second major channel cut through Banana Bend just north of the channel through the oxbow. Both of these new channels were cut through areas where sand mining had been done before, as is the case in the vicinity of the Site. Sonar tests in a 130-foot section south of the I-10 Bridge located adjacent to the Site found about 10 to 12-feet of erosion from the bottom of the river bed.

discharge into and out of the San Jacinto River and may significantly affect variations in flow velocities, sediment transport, suspended sediment loads, and water levels. Hurricane storm surges usually cause increases in water depth of 4 to 6 feet.

Flow rates and freshwater inputs into the San Jacinto River in the vicinity of the Site are partially controlled by the Lake Houston Dam, which is located about 16 river miles upstream of the northern impoundments. The average flow in the river is 2,200 cfs. Floods in the river occur primarily during tropical storms, hurricanes, or intense thunder storms. Extreme flood events have flow rates of 200,000 cfs or greater. Floods can cause water surface elevations to increase by 10 to 20 feet or more (relative to average flow conditions) and force the river out of its main channel. During low-flow conditions when current velocities were dominated by tidal effects, maximum velocities were measured to be about 1 foot per second, with typical velocities of 0.5 foot per second or less during most of the tidal cycle.

Nature and Extent of Contamination – North of I-10

The waste pits north of I-10 contain elevated concentrations of dioxins and furans, and PCBs. The highest average concentrations of dioxin and furans in surface and subsurface material north of I-10 occur in the northern impoundments. The maximum $TEQ_{DF,M}$ concentration in surface material (43,000 ng/kg) occurs in the northwest portion of the western cell of the impoundments. The highest $TEQ_{DF,M}$ value in subsurface material (26,900 ng/kg) also occurs in the southern portion of the western cell. Average and maximum $TEQ_{DF,M}$ concentrations in surface and subsurface media outside of the northern impoundments are much lower than those within the northern impoundments.

The sample with the highest dioxin-like PCB congener toxicity equivalent quotient calculated using toxicity equivalency factors for mammals ($TEQ_{P,M}$), at a concentration of 2.83 ng/kg, was collected from within the northern impoundments. The second highest $TEQ_{P,M}$ concentration (2.23 ng/kg) was found west of the northern impoundments. This and other data show there is no evident spatial pattern for $TEQ_{P,M}$ in north of I-10.

Ground water sampling was conducted at three locations within the perimeter of the northern waste pits from each of two ground water bearing units below the waste pits. These ground water units contained brackish to saline ground water. Samples from five of the six wells did not detect any dioxin or furan. The sixth well screened in the uppermost ground water bearing unit below the waste pits did detect low level dioxin/furan at a concentration (2.64 pg/L) that is much lower than the maximum contaminant level of 30 pg/L for a drinking water zone. A water sample collected from within the waste pits contained 3,770 pg/L.

Nature and Extent of Contamination – Surface Water and Sediment

Surface water samples collected between 2002 and 2009 by the Texas Commission on Environmental Quality and the University of Houston showed elevated levels of dioxins near and downstream from the waste pits. Site sediment contains elevated concentrations of dioxins and furans, and PCBs. Dioxin and furan concentrations in sediments are highest within the perimeter of the northern impoundments than elsewhere at the Site. Within northern impoundments, $TEQ_{DF,M}$ results in sediments are highest in the western cell. $TEQ_{DF,M}$ results in sediment outside of the northern impoundments are typically three to four orders of magnitude lower than those within the impoundments, even in areas directly adjacent to the perimeter. The attached map shows that there are elevated levels of dioxins in river sediments outside of the waste pits.

The highest $TEQ_{DF,M}$ result (31,600 ng/kg) in surface sediment samples occurs in the uppermost 2-foot interval of the core located in the north-central portion of the northern impoundments; cores surrounding it to the north, east, and southeast show much lower concentrations at all intervals. Cores within the western cell tend to show higher $TEQ_{DF,M}$ results throughout the upper core increments. $TEQ_{DF,M}$ results generally decrease from their maximum with depth within a given core indicating that the peak concentrations have been located in the vertical dimension. Outside of the northern impoundments perimeter, $TEQ_{DF,M}$ results in two

Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP § 300.430(a)(1)(iii)(A)). In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile and which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. **Elevated concentrations of $TEQ_{DF,M}$ have been detected at the Site in sediment (more than 43,000 ng/kg) and soil (more than 50,000 ng/kg).** Dioxin and furans are highly toxic and persistent in nature (will not breakdown for hundreds of years). With the regular occurrence of severe storms and flooding in the area, there is uncertainty that the waste material can be reliably contained over the long term and therefore should be considered highly mobile. **Because the dioxin and furan waste in the northern impoundments and southern impoundment at the site is both highly toxic and highly mobile, it is considered a principal threat waste.**

surface sediment samples are above 100 ng/kg, at estimated concentrations of 121 ng/kg and 153 ng/kg. All other $TEQ_{DF,M}$ results in surface sediment outside of the northern impoundment perimeter are generally much lower. In the vicinity of the upland sand separation area (outside of the northern impoundments perimeter; Figure 2), two deep subsurface intervals (4 to 5 feet and 7 to 8 feet below mudline) have $TEQ_{DF,M}$ levels of 349 and 339 ng/kg, respectively, the highest $TEQ_{DF,M}$ measured outside the northern impoundment perimeter.

$TEQ_{P,M}$ concentrations are highest in samples collected from within the northern impoundments perimeter, with the maximum value of 38.1 ng/kg from the 4- to 6-foot depth interval. The $TEQ_{P,M}$ concentrations in most surface and subsurface samples within the northern impoundment exceed 1 ng/kg, while all but two values outside of the northern impoundment are below 1 ng/kg. The exceptions are one surface and one subsurface sample location along the northwest portion of the peninsula south of I-10.

Nature and Extent of Contamination – Tissue

Tissue samples were collected from three Site fish collection areas:

- Downstream of I-10, referred to below as “downstream”
- In the area surrounding the impoundments north of I-10 and the upland sand separation area, referred to as “adjacent to the northern impoundments”
- Immediately upstream of the northern impoundments and upland separation area, referred to as “upstream.”

Data for blue crab, hardhead catfish, clams, and Gulf killifish are summarized in the tables below. The maximum detected values and highest mean values of $TEQ_{DF,M}$ and $TEQ_{P,M}$ generally were collected from the fish collection area adjacent to the northern impoundments. This pattern of contaminant distribution was also observed for $TEQ_{DF,M}$ in hardhead catfish.

Summary of Tissue Results

	FCA 1		FCA 2		FCA 3		Background	
	Downstream		Adjacent to the Northern Impoundments		Upstream			
Chemical	Maximum Detected Value	Mean	Maximum Detected Value	Mean	Maximum Detected Value	Mean	Maximum Detected Value	Mean
Blue Crab								
$TEQ_{DF,M}$	1.91	0.739	0.558	0.23	0.271	0.146	0.639	0.157
$TEQ_{P,M}$	0.234	0.119	0.547	0.242	0.303	0.14	0.169	0.0907
Hardhead Catfish								
$TEQ_{DF,M}$	5.45	2.94	5.85	3.87	5.32	3.29	4.97	0.865
$TEQ_{P,M}$	2.27	1.28	2.03	1.28	2.79	1.36	0.804	0.48
Clams								
$TEQ_{DF,M}$	2.19	1.7	27.0	7.89	1.29	0.838	0.702	0.364
$TEQ_{P,M}$	0.271	0.22	1.9	0.502	0.436	0.366	0.283	0.181
Gulf Killifish								
$TEQ_{DF,M}$	--	0.102	10.1	2.70	0.43	0.404	0.307	0.13
$TEQ_{P,M}$	0.732	0.525	2.92	1.26	0.674	0.510	0.653	0.295

Note:
Results in nanograms per kilogram wet weight, nondetect results set at ½ the detection limit.
Cells with the highest observed values highlighted in blue.
FCA – Fish Collection Area
$TEQ_{DF,M}$ – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient
$TEQ_{P,M}$ – Polychlorinated biphenyl toxicity equivalent quotient

Nature and Extent of Contamination – South of I-10

$TEQ_{DF,M}$ concentrations in surface soil south of I-10 range from 1.35 ng/kg to 36.9 ng/kg. Substantially lower concentrations including the minimum $TEQ_{DF,M}$ concentration of 1.35 ng/kg are found at stations in close proximity to those that exceed the surface soil reference envelope value, or background, of 24.3 ng/kg indicating that these few slightly elevated $TEQ_{DF,M}$ concentrations are localized.

In subsurface soils from 6 to 24 inches, $TEQ_{DF,M}$ results range from 0.134 ng/kg to 303 ng/kg, with an average of 16.5 ng/kg. The second highest result in this depth interval (43.1 ng/kg) is much lower than the maximum. $TEQ_{DF,M}$ results deeper than 2 feet range from 0.092 ng/kg to 50,100 ng/kg and average 743 ng/kg. The maximum core $TEQ_{DF,M}$ occurs at a depth of 6 to 8 feet from a sample collected in the southern part of the soil investigation south of I-10. The majority of the highest core $TEQ_{DF,M}$ concentrations occur between 6 and 12 feet deep, and are associated with stations located near the center of the peninsula south of I-10.

Ground water sampling was conducted at two locations outside of the southern impoundment; one was below the impoundment and the other was located downgradient to the west of the impoundment. The water in this area is brackish. Neither of these samples detected any dioxin or furan. Water samples collected from within the southern impoundment contained dioxin up to a maximum of 60.2 pg/L.

Resource Use

Current land use at the Site is primarily industrial and commercial use. Current land use surrounding the Site includes mixed residential and industrial uses to the west, and undeveloped or residential areas to the east and north. Immediately south of the Site is commercial/industrial land use. The future land use is not anticipated to be different from the current land use.

The area south of the Site is dominated by activities associated with the Houston Ship Channel, specifically industrial sites that are served by the barges and ocean-going vessels that use the Houston Ship Channel. From the Site north to Lake Houston, there is less industrialization along the river.

Commercial and recreational fishing activity occurs throughout Galveston Bay. The San Jacinto River along with nearby Upper Galveston Bay, Tabbs Bay, and the San Jacinto State Park have many points of public access. Through Texas Department of State Health Services (TDSHS) outreach activities, most of the people interviewed along the San Jacinto River, Houston Ship Channel, and Upper Galveston Bay have told TDSHS that they are fishing and/or crabbing for recreational purposes. However, some people do admit to consuming fish and/or crabs from these areas despite the fact that consumption of mollusks and shellfish (clams, mussels, and oysters) taken from public fresh waters is prohibited by TDSHS. Within public salt waters, these shellfish may be taken only from waters approved by TDSHS. TDSHS shellfish harvest maps designate approved or conditionally approved harvest areas. Waters near the Site are not included on these maps.

Although the Site is private land, access points along the San Jacinto River allow for a variety of recreational activities including picnicking, swimming, nature walks, bird watching, wading, fishing, boating, water sports, and other shoreline uses. In the area to the south of the I-10 Bridge on the west side of the river, children and adults have been reported to play along the shoreline, wade in the water, and fish.

Scope and Role of Response Action

There is one operable unit for the Site. The response action proposed in this plan is intended to address the threats to human health and environment. The purpose of this response action is to implement a site-wide strategy that addresses the contaminated environmental media at the Site with the primary objectives of preventing human and ecological exposure to contaminants, and preventing or minimizing further migration of contaminants.

Summary of Site Risks

A Baseline Human Health Risk Assessment (BHHRA) and Baseline Ecological Risk Assessments (BERAs) were conducted to estimate the potential for current/future risk from exposure to contaminants from the Site. The BHHRA and BERAs were conducted to determine potential pathways by which people (human receptors) or animals (ecological receptors) could be exposed to upland or aquatic contamination in sediment, soil, water, or biota; the amount of contamination receptors of concern may be exposed to; and the toxicity of those contaminants if no action were taken to address contamination at the Site.

The risk assessments were conducted on the baseline conditions that existed before the installation of the TCRA armored cap over the northern waste pits that was completed during a removal action. This temporary cap was built to stabilize the northern waste pits and prevent direct human exposures until a permanent remedy could be selected for the Site. These assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action.

It is EPA's current judgement that the Preferred Remedy identified in this Proposed Plan, or one of the other alternatives considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

What is Risk and How is it Calculated?

A Superfund human health risk assessment estimates the “baseline risk.” This is an estimate of the likelihood of health problems occurring if no cleanup action was taken at a site. To estimate the baseline risk at a site, a four-step process is used:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the concentrations of contaminants found at a site are examined as well as past scientific studies that demonstrate the effects these contaminants may have on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure are considered. Using this information, a "reasonable maximum exposure" scenario is calculated, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, the information from Step 2 is combined with information on the toxicity of each chemical to assess potential health risks. Two types of risk, cancer risk and non-cancer risk, are considered. The likelihood of any kind of cancer resulting from a site is generally expressed as an upper-bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer risks, a hazard index (HI) is calculated. The key concept here is that a "threshold level" exists below which non-cancer health effects are no longer predicted.

In Step 4, it is determined if site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The potential risks from the individual chemicals are added up. If cancer or non-cancer risks are found to be unacceptable, the contributing chemicals are then identified as contaminants of concern (COCs). For cumulative cancer risks, the EPA has determined increased cancer risk in excess of 10^{-4} (1 in 10,000) is unacceptable. The risk range of 10^{-6} to 10^{-4} may be evaluated to determine whether risk is acceptable for future site conditions (such as land use and potential users). For cumulative non-cancer risks, the EPA has established an HI of less than 1.0 as acceptable.

Human Health Risk

The BHHRA identified non-cancer hazards greater than one for some recreational fisher exposure scenarios (direct exposure to beach areas identified and the ingestion of catfish, clam, or crab from fishing areas identified), for some recreational visitor exposure scenarios (direct exposure to the beach area identified), and for some future construction worker exposure scenarios. Tables below provide a summary of site related non-cancer hazard quotients above 1.0. There were no cancer risks above the upper limit of

EPA's target cancer risk range (1x10-4) identified in the BHHRA. Figures 3 through 6 provide locations for exposure areas in the tables below.

Non-Cancer Hazards for a Recreational Fisher

Chemical	Primary Target Organ	Non-Cancer Hazard Quotient: Incidental Ingestion of Sediment	Dermal Contact with Sediment	Consumption of Fish or Shellfish	Exposure Route Total
Scenario 1A: Direct Exposure Beach Area A; Ingestion of Catfish from Fish Collection Area 2/3					
$TEQ_{DF,M}$	Reproductive/Developmental	0.00046	0.0013	**1.1**	**1.1**
Scenario 2A: Direct Exposure Beach Area B/C; Ingestion of Catfish from Fish Collection Area 2/3					
$TEQ_{DF,M}$	Reproductive/Developmental	0.0064	0.018	**1.1**	**1.1**
Scenario 3A: Direct Exposure Beach Area E; Ingestion of Catfish from Fish Collection Area 2/3					
$TEQ_{DF,M}$	Reproductive/Developmental	**13**	**37**	**1.1**	**51**
PCBs	Immune	0.049	0.65	0.88	**1.6**
Scenario 3B: Direct Exposure Beach Area E; Ingestion of Clam from Fish Collection Area 2					
$TEQ_{DF,M}$	Reproductive/Developmental	**13**	**37**	0.21	**50**
Scenario 3C: Direct Exposure Beach Area E; Ingestion of Crab from Fish Collection Area 2/3					
$TEQ_{DF,M}$	Reproductive/Developmental	**13**	**37**	0.0032	**50**
Scenario 4A: Direct Exposure Beach Area D; Ingestion of Catfish from Fish Collection Area 1					
$TEQ_{DF,M}$	Reproductive/Developmental	0.0022	0.006	**1.0**	**1.0**

Note:
PCBs – Polychlorinated Biphenyls
$TEQ_{DF,M}$ – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient

Non-Cancer Hazards for a Recreational Visitor

Chemical	Primary Target Organ	Non-Cancer Hazard Quotient: Incidental Ingestion of Sediment	Incidental Ingestion of Soil	Dermal Contact with Sediment	Dermal Contact with Soil	Total
Scenario 3: Direct Exposure Beach Area E						
$TEQ_{DF,M}$	Reproductive/ Developmental	**17**	0.03	**49**	0.0021	**66**

Note:
$TEQ_{DF,M}$ – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient

Non-Cancer Hazards for a Future Construction Worker

Chemical	Primary Target Organ	Non-Cancer Hazard Quotient: Incidental Ingestion of Soil	Dermal Contact with Soil	Total
Scenario DS-1: Direct Exposure to Surface and Subsurface Soils				
$TEQ_{DF,M}$	Reproductive/Developmental	**9.6**	0.49	**10**
Scenario DS-2: Direct Exposure to Surface and Subsurface Soils				
$TEQ_{DF,M}$	Reproductive/Developmental	**44**	**2.2**	**46**
Scenario DS-4: Direct Exposure to Surface and Subsurface Soils				
$TEQ_{DF,M}$	Reproductive/Developmental	**32**	**1.6**	**34**
Scenario DS-5: Direct Exposure to Surface and Subsurface Soils				
$TEQ_{DF,M}$	Reproductive/Developmental	**2.2**	**0.11**	**2.3**

Note:
$TEQ_{DF,M}$ – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient

Ecological Risk

The BERAs identified risk to ecological receptors as summarized in the tables below.

Ecological Risks for the Area North of I-10 and Aquatic Environment

Receptor of Concern	Feeding Guild	Contaminant of Concern	Baseline Risk Identified
Benthic Macroinvertebrates			
Mollusks	Filter feeders	2,3,7,8-TCDD	Reproductive risks to mollusks (primarily in the area which surrounds the waste impoundments)
Individual mollusks	Filter feeders	2,3,7,8-TCDD	Low risks of reproductive effects (sediments adjacent to the upland sand separation area)
Birds			
Spotted sandpiper	Invertivore (probing)	Dioxins and furans	Moderate risks to individual birds, low risk to populations
Killdeer	Invertivore (terrestrial)	Dioxins and furans	Moderate risks to individual birds, low risk to populations
Mammals			
Marsh rice rat	Omnivore	$TEQ_{DF,M}$	Risk to individual small mammals with home ranges that include areas adjacent to the impoundments; low to negligible risk to populations

Note:
2,3,7,8-TCDD – 2,3,7,8-tetrachlorodibenzo-p-dioxin
Dioxins – polychlorinated dibenzo-p-dioxins
Furans – polychlorinated dibenzofurans
$TEQ_{DF,M}$ – toxicity equivalent quotient for 2,3,7,8-tetrachlorodibenzo-p-dioxin calculated using toxicity equivalent factors for mammals

Ecological Risks for the Area South of I-10

Receptor of Concern	Feeding Guild	Contaminant of Concern	Baseline Risk Identified
Birds			
Killdeer	Invertivore (terrestrial)	Lead Zinc	Risks to individual birds are present and population-level risks may be present; however, this is an industrial site with very poor habitat

Remedial Action Objectives and Preliminary Remediation Levels

Remedial Action Objectives (RAOs) describe what the proposed site cleanup is expected to accomplish. According to the NCP, 40 CFR §300.430(a)(1)(i), the "national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, site specific RAOs were developed. The RAOs developed consider the current and reasonably anticipated future land use including the use for industrial applications and by recreational fishers. While the BHHRA considered subsistence fisher populations, none have been identified at the Site and therefore this receptor is not considered to be consistent with the current or future land use.

Remedial Action Objectives

1) Eliminate loading of dioxins and furans from the former waste impoundments north and south of I-10 to sediments of the San Jacinto River.

2) Reduce human exposure to dioxins and furans from consumption of fish by remediating paper mill waste and impacted sediments to appropriate cleanup levels.

3) Reduce human exposure to dioxins and furans from direct contact with paper mill waste, soil, and sediment by remediating affected media to appropriate cleanup levels.

4) Reduce exposures of benthic invertebrates, birds, and mammals to paper mill waste-derived dioxins and furans by remediating media affected by paper mill wastes to appropriate cleanup levels.

The following Preliminary Remediation Goals provide numerical criteria that will be used to measure the progress in meeting the RAOs. Preliminary Remediation Goals are acceptable exposure levels (i.e., contaminant concentration levels) that are protective of human health and the environment, and are developed considering applicable, relevant, and appropriate requirements (ARARs), as specified in the NCP. Concentrations of PCBs in sediments were either significantly correlated with concentrations of tetrachlorodibenzo-p-dioxin and furan indicating that remediation for dioxins and furans will also address the PCBs, or were generally below detection limits. The term "Remediation Level" is used in order to make clear that the remedy establishes binding requirements to ensure that RAOs are satisfied. Site Preliminary Remediation Levels are presented below:

- $TEQ_{DF,M}$ in paper mill waste and sediment – 200 ng/kg
- $TEQ_{DF,M}$ in subsurface soil – 240 ng/kg
- Texas Surface Water Quality Standard for Dioxins/Furans – 7.8 x 10^{-8} µg/L (as TCDD equivalents)

Summary of Remedial Alternatives

The FS identified and screened possible response actions and remedial technologies applicable to the Site. Following the screening process, remedial alternatives were developed to address the area north of I-10 and the area south of I-10. Alternatives that address the area north of I-10 and aquatic environment include the letter "N" in the title (e.g., 1N, 2N), and alternatives that address the area south of I-10 include the letter "S" in the title (e.g., 1S, 2S).

Alternative 1N – Armored Cap and Ongoing Operations, Monitoring, and Maintenance (No Further Action)

Estimated Maintenance Cost (e.g., inspection, maintenance, 5-year reviews): $520,000
Estimated Total Present Worth Cost: $520,000
Estimated Construction Time: Construction complete

Under this alternative, the controls installed as part of the TCRA and as a result of the TCRA reassessment would remain in place and no additional remedial action would be implemented. This alternative includes ongoing operations, monitoring, and maintenance of the armored cap, which includes inspection and periodic maintenance, and EPA 5-year reviews as required under the NCP in 40 CFR 300.430 (f)(iv)(2).

Alternative 2N – Armored Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery

Estimated Maintenance Cost: $1,400,000
Estimated Total Present Worth Cost: $1,400,000
Estimated Construction Time: Construction complete

This alternative includes all of the elements discussed under Alternative 1N, plus institutional and engineering controls, ground water monitoring, and Monitored Natural Recovery (MNR). MNR would be used to achieve the PRG for sediment in the sand separation area and the Texas Surface Water Quality Standard in the San Jacinto River. Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place. Under this remedial alternative, the following institutional and engineering controls would be implemented:

- Restrictions on dredging and anchoring would be established to protect the integrity of the armored cap and to limit potential disturbance and resuspension of buried sediment near the upland sand separation area where one location exists with $TEQ_{DF,M}$ concentrations exceeding the sediment cleanup goal.

- Alert property owners of the presence of subsurface materials exceeding Remediation Levels.

- Public notices and signage around the perimeter of the TCRA site would be maintained or provided, as appropriate.

A periodic sampling and analytical program would also be implemented to monitor the progress of natural recovery.

Institutional Controls

Institutional controls are non-engineered instruments such as administrative and legal controls that help minimize the potential for human exposure to contamination and protect the integrity of a remedy by limiting land or resource use.

Engineering Controls

Engineering controls are physical measures such as fencing or signage that are used to limit access to contaminated areas or areas that may pose a physical hazard.

Monitored Natural Recovery

MNR is a technology in which contaminant concentrations are monitored with no other remedial actions taken to address contamination. MNR assesses the natural attenuation of contaminants by physical, chemical, and biological processes.

Alternative 3N – Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery

Estimated Capital Cost: $2,210,000
Estimated Post Construction Cost: $1,400,000
Estimated Total Present Worth Cost: $2,610,000
Estimated Construction Time: 2 months

This alternative includes the actions described under Alternative 2N plus additional enhancements to the TCRA armored cap to create a permanent cap. This alternative will increase the long-term stability of the armored cap consistent with isolation of impacted materials. Cost estimates for this alternative also include additional measures to protect the permanent cap from potential vessel traffic in the form of a protective perimeter barrier and could include construction of a 5-foot high submerged rock berm outside the perimeter of the permanent cap, in areas where vessels could potentially impact the cap. MNR would be used to achieve the PRG for sediment in the sand separation area and the Texas Surface Water Quality Standard in the San Jacinto River.

Enhancements to the armored cap would involve flattening the slopes of the existing cap by adding additional armor rock material to enhance the effectiveness and permanence by increasing the degree of safety. The permanent cap would include 1.5 for sizing the armor stone, flattening submerged slopes from 2 horizontal to 1 vertical (2H:1V) to 3H:1V, and flattening the slopes in the surf zone from 3H:1V to 5H:1V. The permanent cap would use larger rock sized for the “No Displacement” design scenario, which is more conservative than the “Minor Displacement” scenario used in the armored cap’s design. Upon completion, the Permanent Cap would be constructed to a standard that exceeds EPA and USACE design guidance, and meets or exceeds the recommended enhancements suggested by USACE in their 2013 evaluation. Institutional controls would be implemented to place restrictions on dredging and anchoring to protect the integrity of the armored cap and to limit potential disturbance and resuspension of buried sediment near the upland sand separation area where one location exists with $TEQ_{DF,M}$ concentrations exceeding the sediment cleanup goal.

Alternative 4N – Partial Solidification/Stabilization, Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery

Estimated Capital Cost: $12,870,000
Estimated Post Construction Cost: $1,400,000
Estimated Total Present Worth Cost: $14,270,000
Estimated Construction Time: 17 months

This remedial alternative provides for solidification and stabilization of the most highly contaminated material. A dioxin and furan value that exceeds 13,000 ng/kg $TEQ_{DF,M}$ was used to define the most highly contaminated material. The extent of the area for partial solidification and stabilization is the western cell and a portion of the eastern cell that is currently covered by the TCRA armored cap. The maximum depth of solidification and stabilization in the western cell would be to approximately 10-feet below the current base of the armored cap and on average approximately 5-feet below the current base of the armored cap in the eastern cell and northwestern area.

Solidification and stabilization treatment could be accomplished using large-diameter augers or conventional excavators. Before treating the sediment, the affected portions of the armored cap armor rock would need to be removed and stockpiled for reuse, if possible, or washed to remove adhering sediment and disposed in an appropriate upland facility. The geotextile and geomembrane would need to be removed and disposed of as contaminated debris. Solidification and stabilization reagents, such as Portland cement, would be mixed with sediment, as needed, to treat the sediment *in situ*. Submerged areas to be stabilized would need to be isolated from the surface water with sheet piling and mostly dewatered prior to mixing with treatment reagents using conventional or long reach excavators.

Finally, the permanent cap, as described in Alternative 3N, would be constructed, including replacement of the armor rock layer geomembrane and geotextile over the solidification and stabilization footprint; and the measures described under Alternative 3N to protect the permanent cap from vessel traffic would be implemented. MNR would be used to achieve the PRG for sediment in the sand separation area and the Texas Surface Water Quality Standard in the San Jacinto River. Institutional controls would be implemented to place restrictions on dredging and anchoring to protect the integrity of the armored cap and to limit potential disturbance and resuspension of buried sediment near the upland sand separation area where one location exists with $TEQ_{DF,M}$ concentrations exceeding the sediment cleanup goal. Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place.

The estimated footprint of this alternative is approximately 2.6 acres in the western cell and 1.0 acre of submerged sediment spanning the eastern cell and the northwestern area. Based on the horizontal and vertical limits identified for this alternative, a total of approximately 52,000 cubic yards of soil and sediment would be treated.

Alternative 5N – Partial Removal, Permanent Cap, Institutional Controls, and Monitored Natural Recovery

Estimated Capital Cost: $27,820,000
Estimated Post Construction Cost: $1,400,000
Estimated Total Present Worth Cost: $29,220,000
Estimated Construction Time: 13 months

This remedial alternative provides for removal and offsite disposal of the most highly contaminated material. A dioxin and furan value that exceeds 13,000 ng/kg $TEQ_{DF,M}$ was used to define the most highly contaminated material. The lateral and vertical extent and volume of sediment removed under this alternative is the same as the sediment to be treated as described in the previous section for alternative 4N. Construction of a permanent cap, institutional controls, and MNR, as described in Alternative 3N, are also included in this remedial alternative.

To mitigate potential water quality issues, submerged areas would need to be isolated using berms, sheet piles, and/or turbidity barrier/silt curtains prior to excavating sediment. Upland areas would not need to be isolated with sheet piling, but the excavation would require continuous dewatering and may need to be timed to try to avoid high water and times of year when storms are most likely.

Excavated sediment would be dewatered and potentially treated to eliminate free liquids prior to transporting it for disposal. Effluent from excavated sediment dewatering would need to be handled appropriately, potentially including treatment prior to disposal. Following completion of the excavation, the work area would be backfilled to replace the excavated sediment and then the permanent cap would be constructed, including replacing the armor rock layer above the excavation footprint and the geomembrane and geotextile layers. Institutional controls would be implemented to place restrictions on dredging and anchoring to protect the integrity of the armored cap and to limit potential disturbance and resuspension of buried sediment near the upland sand separation area where one location exists with $TEQ_{DF,M}$ concentrations exceeding the sediment cleanup goal. Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place.

Alternative 5aN - Partial Removal of Materials Exceeding Cleanup Levels, Permanent Cap, Institutional Controls, and Monitored Natural Recovery

Estimated Capital Cost: $67,600,000
Estimated Post Construction Cost: $1,400,000
Estimated Total Present Worth Cost: $69,000,000
Estimated Construction Time: 19 months

For this alternative, the cleanup goal for a recreational visitor (200 ng/kg $TEQ_{DF,M}$) was considered for the area within the armored cap, which is either above the water or where the water depth is 10 feet or less. As an additional criterion, locations exceeding 13,000 ng/kg $TEQ_{DF,M}$ are also included regardless of water depth; however, all samples exceeding 13,000 ng/kg $TEQ_{DF,M}$ are located in areas where the water depth is 10 feet or less.

As with Alternatives 4N and 5N, the existing armored cap (consisting of cap rock, geomembrane, and geotextile) which currently isolates and contains impacted material would need to be removed prior to beginning excavation work.

This alternative also includes an engineered barrier to manage water quality during construction. In shallow water areas (water depths up to approximately 3 feet), this barrier would be constructed as an earthen berm, extending to an elevation at least 2 feet above the high water elevation in consideration of wind-generated waves and vessel wakes.

Work would be conducted in the wet. Excavated sediment would be offloaded, dewatered, and stabilized at a dedicated offloading location, as necessary, to eliminate free liquids for transportation and disposal. Following removal of impacted sediment, the area from which sediments are removed would be covered with a residuals management layer of clean cover material.

In the deeper water areas of the TCRA site where removal is not conducted, the existing armored cap would be maintained. MNR would be used to achieve the PRG for sediment in the sand separation area and the Texas Surface Water Quality Standard in the San Jacinto River. Institutional controls would be implemented to place restrictions on dredging and anchoring to protect the integrity of the armored cap and to limit potential disturbance and resuspension of buried sediment near the upland sand separation area where one location exists with $TEQ_{DF,M}$ concentrations exceeding the sediment cleanup goal. Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place.

This alternative entails removal of approximately 137,600 cubic yards of sediment.

Alternative 6N - Full Removal of Materials Exceeding Cleanup Levels, Institutional Controls, and Monitored Natural Recovery

Estimated Capital Cost: $101,550,000
Estimated Post Construction Cost: $650,000
Estimated Total Present Worth Cost: $102,200,000
Estimated Construction Time: 16 months

For the full removal alternative, the recreational visitor exposure scenario was considered for area north of I-10. The cleanup goal for protection of the recreational visitor is a $TEQ_{DF,M}$ concentration of 200 ng/kg.

The full removal alternative will utilize Best Management Practices (BMPs) to reduce the re-suspension of sediment and release to the river. The removal will be completed in stages or sections as appropriate to limit the exposure of the uncovered sections of the waste pits to potential storms. Raised berms, sheet piles, and silt curtains in addition to dewatering and removal in the dry to the extent practicable will be used to reduce the re-suspension and spreading to the removed material. The berms would be armored on the external site with armor material removed from the areas that have geotextile present. Residual concentrations of contaminants following excavation and dredging will be covered by at least two layers of clean fill to limit intermixing of residual material with the clean fill. As with the partial removal alternatives, cap rock, geomembrane, and geotextile from the existing armored cap, which currently isolates and contains impacted material, would be removed prior to beginning excavation. Dredging of submerged sediments will include isolation of the work area with a turbidity barrier/silt curtain and raised berms/sheet piles where practicable. Excavated sediment would be dewatered and stabilized at the offloading location, as necessary, to eliminate free liquids for transportation and disposal. Some operations, such as water treatment, may be barge mounted. Following removal of impacted sediment, the area from which sediments are removed will be covered with at least two residuals management layers of clean sediment to reduce intermixing. Institutional controls will be used to prevent disturbance of the dredge residuals below the cover layers in the remediated areas.

This alternative entails removal of approximately 200,100 cubic yards of sediment from the TCRA footprint and the area near the upland sand separation area, which would require a relatively large offloading and sediment processing facility to efficiently accomplish the work, which would require barge unloading, sediment re-handling, dewatering, stockpiling, transloading, and shipping to the offsite landfill facility. Additional activities would include management and disposal of dewatering effluent, including treatment if necessary. Soil that is removed would be transported in compliance with applicable requirements and permanently managed in a permitted landfill cleared by the EPA's regional offsite rule contact.

MNR would be used to achieve the Texas Surface Water Quality Standard in the San Jacinto River.

Alternative 1S – No Further Action

Estimated Capital Cost: $0
Estimated Post Construction Cost: $143,000
Estimated Total Present Worth Cost: $143,000
Estimated Construction Time: None

Under this remedial alternative for the area of investigation south of I-10, impacted soil would remain in place and no steps would be taken to alert future landowners or construction workers of the presence, at depth, of $TEQ_{DF,M}$ concentrations exceeding cleanup goals. The estimated cost for this alternative includes the cost of future EPA five-year reviews.

Alternative 2S – Institutional Controls and Ground Water Monitoring

Estimated Capital Cost: $133,000
Estimated Post Construction Cost: $240,000
Estimated Total Present Worth Cost: $373,000
Estimated Construction Time: None

This alternative would apply to locations in the area south of I-10 where the average $TEQ_{DF,M}$ concentration in the upper 10 feet of soil below grade exceeds the cleanup goal for the future construction worker

(240 ng/kg $TEQ_{DF,M}$). $TEQ_{DF,M}$ concentrations in the upper 10 feet of soil exceed the cleanup goal at four locations. Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place. Under this remedial alternative, the following institutional controls would be implemented:

- Deed restrictions would be applied to parcels in which the depth-weighted average $TEQ_{DF,M}$ concentrations in the upper 10 feet of subsurface soil exceed the soil cleanup goal for the future construction worker

- Notices would be attached to deeds of affected properties to alert potential future purchasers of the presence of waste and soil with $TEQ_{DF,M}$ concentrations exceeding the soil cleanup goal.

Alternative 3S – Enhanced Institutional Controls and Ground Water Monitoring

Estimated Capital Cost: $523,000
Estimated Post Construction Cost: $243,000
Estimated Total Present Worth Cost: $766,000
Estimated Construction Time: 1 month

This remedial alternative would incorporate the Institutional controls identified in Alternative 2S and add physical features to enhance the effectiveness of the institutional controls. The physical features would include bollards to define the areal extent of the remedial action areas at the surface and a marker layer that would alert workers digging in the area that deeper soil may be impacted.
Implementation of this remedial alternative may include the following steps:

- Removing up to 2 feet of surface soil

- Temporarily stockpiling the soil onsite

- Placing the marker layer (such as a geogrid or similar durable and readily visible material) at the bottom of the excavation

- Returning the soil to the excavation and re-establishing vegetative cover

- Placing bollards at the corners of the remedial action areas.

- Ground water monitoring would be implemented to ensure that there are no long-term unacceptable impacts to ground water resulting from the waste left in place.

Alternative 4S – Removal and Offsite Disposal

Estimated Capital Cost: $9,792,000
Estimated Post Construction Cost: $140,000
Estimated Total Present Worth Cost: $9,932,000
Estimated Construction Time: 7 months

This remedial alternative involves excavation and replacement of soil in the areas exceeding the preliminary remediation goals. Soil would be removed within these areas to a depth of 10 feet below grade. Implementation of this remedial alternative would require dewatering (groundwater lowering) to allow excavation of impacted soil in relatively dry conditions, and may need to be timed to try to avoid high water and periods when storms are most likely. Excavated soil would be further dewatered, as necessary, and potentially treated to eliminate free liquids prior to transporting it for disposal. Effluent from excavation and subsequent dewatering would need to be handled appropriately, potentially including treatment prior to disposal. Excavated soil would be disposed of at an existing permitted landfill, the excavation would be backfilled with imported soil, and vegetation would be re-established. An existing building (an elevated frame structure) and a concrete slab would need to be demolished and removed prior to excavating the underlying soil. These features would be replaced, if necessary.

The removal volume (50,000 cubic yards) was calculated assuming a conservative excavation side slope of 2 horizontal to 1 vertical. Transportation and disposal costs were estimated assuming that all of the excavated material would be transported to a licensed landfill for disposal.

Evaluation of Alternatives

This section of the Proposed Plan discusses the relative performance of each alternative against the nine criteria and the rationale for selecting the Preferred Alternatives. The 11 alternatives are as follows, one must be selected for each area (north and south):

- 1N – Armored Cap and Ongoing Operations, Monitoring, and Maintenance (No Further Action)
- 2N – Armored Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery
- 3N – Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery
- 4N – Partial Solidification/Stabilization, Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery
- 5N – Partial Removal, Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery
- 5aN – Partial Removal of Materials Exceeding Cleanup Levels, Permanent Cap, Institutional Controls, Ground Water Monitoring, and Monitored Natural Recovery
- 6N – Full Removal of Materials Exceeding Cleanup Levels, Institutional Controls, and Monitored Natural Recovery

- 1S – No Further Action
- 2S – Institutional Controls and Ground Water Monitoring
- 3S – Enhanced Institutional Controls and Ground Water Monitoring
- 4S – Removal and Offsite Disposal.

Alternative Evaluation

The NCP requires the use of nine criteria to evaluate the difference of remediation alternatives individually and in comparison to each other. These criteria include *threshold criteria*, which requires that each alternative must meet in order to be eligible for selection. *Primary balancing criteria* are used to weigh major trade-offs among alternatives, and *modifying criteria* involve state and community acceptance.

The two threshold criteria are: 1) overall protection of human health and the environment, and 2) compliance with ARARs. The five primary balancing criteria are: 3) long-term effectiveness and permanence; 4) reduction of toxicity, mobility, or volume through treatment; 5) short-term effectiveness; 6) implement-ability; and 7) cost. The two modifying criteria are: 8) state acceptance, and 9) community acceptance. EPA assesses public comment on the Proposed Plan to gauge community acceptance.

United States Army Corps of Engineers 2016 Evaluation

The USACE 2016 report regarding the TCRA armored cap provided the following information that is relevant to consideration of the TCRA armored cap and long-term permanence.

The most severe event simulated was the hypothetical synoptic occurrence of Hurricane Ike and the October 1994 flood, with a peak discharge of approximately 115,000 cubic feet per second occurring at the time of the peak storm surge height at the Site. The results during the peak of the storm surge showed that the sections using Armor A (D50 = 3 inches) were completely eroded, while the sections using Armor D (D50 = 10 inches) were eroded more than 12 inches in about 33 percent of those sections. The sections using Armor B and C (D50 = 6 inches) incurred a net erosion of more than 9 inches in about 75 percent of those areas. The scenario defined above might cause significant erosion of the paper mill waste. The releases from catastrophic events can potentially be addressed by additional modifications, including upgrading the blended filter in the Northwestern Area to control sediment migration into the cap, upgrading the armor stone size in vulnerable areas by about two inches to prevent movement during very severe hydrologic and hydrodynamic events, and thickening of the armor cap in the Eastern Cell to 24 to 30 inches across the site to minimize the potential for disturbance. However, the uncertainty inherent in any quantitative analysis technique used to estimate the long-term (500 years or more) reliability of the cap is very high.

Changes in channel planform morphology due to bank erosion, shoreline breaches, etc. during a high flow event caused by a major flood or hurricane is beyond the ability of existing sediment transport models to simulate.

There appears to be no documented cases of any armored cap or armored confined disposal facility breaches. However, there have been many occurrences of breaches and slope failures of armored dikes, jetties, and breakwaters, with some of those structures confining dredged material.

The FS contains a detailed analysis of each alternative against the criteria and a comparative analysis of how the alternatives compare to each other, a summary is provided below.

Threshold Criteria

All of the remedial alternatives evaluated in the FS for the area north of I-10 satisfy the threshold criteria of protecting human health and the environment and addressing ARARs. The surface-weighted average $TEQ_{DF,M}$ concentration in surface sediments (which are associated with a variety of dioxin sources in addition to paper mill waste that was placed in the impoundments) was reduced by more than 80 percent by the implementation of the TCRA. The current (post-TCRA) condition potential for exposure to $TEQ_{DF,M}$ concentrations is protective of human health and the environment, unless there is a future release, which may result from an extreme storm or hurricane, or the impacts of a barge strike. However, based on historical storm activity and the potential for future storm activity (discussed on pages 5 and 6), and the evaluation of the TCRA armored cap completed by USACE (page 21), and the long-term persistence and toxicity of dioxin, the overall protection of human health and the environment is uncertain with regard to alternatives that rely on an TCRA armored cap.

Other than Alternative 1S, the remedial alternatives for the area south of I-10 considered in the FS Report meet both of the threshold criteria: protectiveness and compliance with ARARs. The potentially affected receptor (future construction worker) would be protected from exposure to soil with elevated $TEQ_{DF,M}$

concentrations by warnings and restrictions (Alternatives 2S and 3S) or removal of impacted soil (Alternative 4S). With reasonable care, any of the remedial alternatives could be implemented in compliance with ARARs. Soil that is removed (Alternative 4S) would be transported in compliance with applicable requirements and permanently managed in a permitted landfill cleared by the EPA's regional offsite rule contact.

Primary Balancing Criteria – Long-Term Effectiveness and Permanence

Alternatives 1N, 2N, and 3N are containment alternatives that provide substantial long-term protectiveness. Alternatives 4N, 5N, and 5aN all provide increased long term effectiveness compared to Alternatives 1N, 2N, and 3N because the most highly contaminated waste would either be stabilized or removed. As discussed in the site characteristics section (pages 5 and 6) the area is prone to tropical storms and hurricanes which could damage a cap. Alternative 6N provides the greatest long-term protectiveness and effectiveness because the waste material, except for the dredge residuals below the cover layers, would be permanently removed from the San Jacinto River and there would be no potential for a future release above the risk based level from the Site. Also, with Alternative 6N, there would be no concerns regarding the long-term viability and effectiveness of a maintenance program that would have to endure for an extremely long time (750 years by one estimate). Alternative 6N is also the only alternative that provides for complete removal of the principle threat waste from the northern impoundments. Ground water monitoring would be included in Alternatives 2N through 5aN, where waste above the preliminary remediation goals is left in place, to confirm that there would be no long-term future unacceptable impacts to ground water.

For the area south of I-10, soil with $TEQ_{DF,M}$ concentrations exceeding the cleanup goal is isolated from the surface by relatively clean overburden. The only route of potential exposure is through excavation into the impacted depth interval. The physical markers (Alternative 3S) would draw attention to the institutional controls and enhance their effectiveness. Alternative 4S would achieve long-term effectiveness by permanently removing the impacted soil from the 0- to 10-foot depth interval from the Site and securely disposing of the soil in a permitted landfill. While the institutional controls, particularly with the addition of physical markers (Alternative 3S), would provide reliable long-term protection, they rely on the integrity of future construction workers to comply with the restrictions. Therefore, complete removal of the impacted soil in the depth interval of potential excavation (Alternative 4S) will provide the highest level of long-term effectiveness because it is not subject to inappropriate future use of the area or any erosion/scour of the waste material that may result from a future extreme storm. Alternative 4S is also the only alternative that provides for complete removal of the principle threat waste from the southern impoundment. Ground water monitoring would be included in Alternatives 2S and 3S, where waste above the preliminary remediation goals is left in place, to confirm that there would be no long-term future unacceptable impacts to ground water.

Primary Balancing Criteria – Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 1N and 2N do not include additional measures to reduce the toxicity, mobility, or volume of material. However, a portion of the soils in the western cell were previously solidified during the TCRA. Thus, these alternatives are comparable in reduction of toxicity, mobility, or volume of material. Alternative 3N further reduces potential mobility within the TCRA site by increasing the protection of the armored slopes, and thus ranks more favorably than Alternatives 1N and 2N. Alternatives 4N and 5N take additional measures through solidification and stabilization (Alternative 4N) or removal (Alternative 5N) of approximately 52,000 cubic yards of sediments and soils, and are comparatively better than Alternative 3N for reduction of toxicity, mobility, or volume of material. Alternative 5aN removes approximately 137,600 cubic yards of sediment, and thus compares more favorably for reduction of toxicity, mobility, or volume of material than Alternatives 4N and 5N. Alternative 6N has the greatest volume of removal – 200,100 cubic yards. This alternative is the most effective in reducing the toxicity, mobility, and volume of waste compared to all of the other alternatives.

Alternatives 2S and 3S do not include any treatment of impacted soil. Alternative 4S would include some treatment of excavated soil, as needed to eliminate free liquids for transportation and disposal. The treatment may involve amendment of the soil with Portland cement or similar product, which would reduce the potential mobility of contaminants of concern (COCs).

Primary Balancing Criteria – Short-Term Effectiveness

Alternatives 1N and 2N do not entail any construction, and thus have no short-term impacts. Alternative 3N has the shortest construction duration (two months) of the remaining alternatives. Alternatives 4N, 5N, 5aN, and 6N have estimated construction durations ranging from 13 to 19 months. Alternative 3N does not result in water column, sediment, or tissue impacts (except for minor turbidity during armor rock placement), and has the lowest risk to worker safety, the lowest greenhouse gas and particulate matter emissions, and the least traffic and ozone (smog) impact. Further, Alternative 3N does not disturb the armored cap or require handling of sediments. Compared to Alternatives 4N, 5N, 5aN, and 6N, which have longer durations, Alternative 3N ranks more favorably for short-term effectiveness.

Alternatives 4N, 5N, 5aN, and 6N each have risk of short-term impacts associated with residuals and releases during construction. Because of their longer duration, these alternatives also have a higher likelihood that a high-water event during construction could overtop perimeter water quality control features, which would exacerbate short-term impacts because the armor cap needs to be removed to accomplish the work. Alternatives 4N, 5N, 5aN, and 6N have predicted increases in water column 2,3,7,8-TCDD concentrations over alternatives 1N, 2N, and 3N. However, the actual levels would be reduced to the maximum extent practicable by the use of BMPs during construction.

Alternative 4N has a longer construction duration than Alternatives 5N and 6N, and all entail removing portions of the armored cap and managing a volume of sediments. Compared to Alternative 3N, there is higher risk to worker safety (8 to 9 times the number of injuries and fatalities) and higher environmental impacts (8 to 9 times the number of hours of operation and truck trips) due to releases that would be expected during construction. Alternative 4N is considered similar to Alternative 5N for emissions of ozone precursors, particulate matter (smog-forming), and greenhouse gases; under Alternative 4N, construction is limited to work within the Site perimeter and does not result in additional emissions during offsite shipment of sediments, but this is counter balanced by the shorter duration of Alternative 5N.

Alternatives 5aN and 6N have the longest construction duration. Alternatives 5aN and 6N are the least favorable for short-term effectiveness. The greater number of work hours has attendant higher worker safety risk (20 times the number of injuries and fatalities compared to Alternative 3N) and higher emissions of ozone precursors, particulate matter (smog-forming), and greenhouse gases (20 times the number of equipment operating hours and truck trips compared to Alternative 3N). The time required for Alternatives 5aN and 6N to achieve protection is also longer. Alternative 6N has the most short-term environmental impact due to water column releases during dredging, and the expected localized increase in tissue concentrations from these releases, as well as generated dredge residuals, may increase the overall surface weighted average concentration $TEQ_{DF,M}$ immediately following dredging. However, the actual levels would be reduced by the use of BMPs during construction, which may include raised berms, sheet piles, dewatering, and excavation in the dry, two layers of residuals cover, etc. The application of BMPs for construction will be determined during the Remedial Design.

BMPs may be successful in mitigating potential resuspension and releases. During construction, however, BMPs could be overwhelmed during significant storm and flood events. For alternatives 4N, 5N, 5aN, and 6N, which require removal of the armored cap during construction, the consequences of flooding could be significant as the exposed and disturbed materials would be at risk of spreading beyond the remedial area. Therefore, these alternatives will include design and construction methodologies to mitigate and reduce the impact of storms during construction. These methodologies may include armor cap removal in sections, operational controls, etc.

Alternative 2S for the southern area does not entail any construction, and thus has no short-term impacts. Excavations (Alternatives 3S and 4S) would require BMPs to control dust and storm water. Short-term impacts associated with Alternative 3S would be minimal given the shallow depth of excavation, limited volume of material that would be moved, and absence of significant concentrations of COCs in the shallow soil. Alternative 4S would require exposing soil with $TEQ_{DF,M}$ concentrations exceeding the Preliminary Remediation Levels, which introduces the potential for exposure to COCs through direct contact with the soil, inhalation or ingestion of impacted dust, and contact with impacted soil suspended in runoff. The volume of soil and the duration of the project would also be greater than for Alternative 3S; and Alternative 4S would require offsite transportation of the soil to a disposal facility, increasing the potential for exposure to COCs, emissions of greenhouse gasses, nitrogen oxides, and particulate matter, and potential tracking of COCs offsite. However, measures developed in the Remedial Design would be implemented to reduce the amount of any materials lost during transportation.

Primary Balancing Criteria – Implementability

Alternatives 1N and 2N do not have any implementability issues because they do not entail construction. Both are more favorable from an implementability standpoint compared to Alternatives 3N, 4N, 5N, 5aN, and 6N. Alternative 3N is a short-duration project that entails proven technology (i.e., the same activities were demonstrated during construction of the armored cap) that can be deployed with readily-available materials and local, experienced contractors.

Implementability issues, such as TCRA site access, limited staging areas, restrictions on equipment size, and availability of offsite staging area properties are greater for Alternatives 4N, 5N, 5aN, and 6N compared to Alternative 3N because of the much larger scope and scale of these alternatives. Identifying and securing an offsite staging area is considered an even greater challenge for Alternatives 5N, 5aN, and 6N compared to Alternative 4N because dredged sediment may need to be managed at the offsite staging area, which requires a larger footprint, and given the nature of the dredged material, might make finding a willing landowner difficult. Proper management of cap material and excavated wastes, and onsite processing and management for dredged sediments for offsite transportation to neighboring roadways, will be critical for effective implementation of Alternatives 5N, 5aN, and 6N. Based on these factors, Alternative 3N is less favorable than Alternatives 1N and 2N, but more favorable than the remaining alternatives.

Alternative 4N requires the removal of the armored cap, and requires solidification and stabilization to be completed for an area of sediments that is typically submerged and would need to be dewatered, which is considered a technical challenge. Engineering controls for Alternative 4N may be challenged to prevent the release of sediments exceeding cleanup goals to the surrounding environment; this would be especially true during potential high flow events that could occur during construction. Alternative 4N is considered to be less favorable for implementability compared to Alternative 3N.

Alternatives 5N, 5aN, and 6N also require removal of the armored cap and management of sediment and soil for offsite disposal. Similar to Alternative 4N, engineering controls may be challenged to prevent the release of sediments exceeding cleanup goals to the surrounding environment. For Alternatives 4N through 6N there is a chance that a high water event could occur during construction resulting in overtopping of the engineering controls. Thus, all of these alternatives are considered equally less favorable as Alternative 4N for implementability compared to Alternatives 1N, 2N, and 3N. However, the impact of high water events will be mitigated by the use of BMPs during construction including raised berms, sheet piles, removal in sections, and operational controls including scheduling that will be developed during the Remedial Design.

For the southern area, there are no significant implementability concerns associated with Alternatives 2S and 3S. None of the alternatives requires specialized equipment, techniques, or personnel. Coordination with property owners would be required to establish institutional controls and for access to the project work site. Alternative 4S would involve more physical activity for implementation, including offsite transportation of impacted soil, but the operations are routine for remedial actions. The additional implementability concerns are the increased truck traffic on Market Street and the potential for flooding while impacted soil is exposed during implementation of Alternative 4S. Provisions may need to be made to handle the additional volume of traffic. The duration of the excavation should not exceed 7 months, and implementation could be timed for periods when high water is least likely.

Primary Balancing Criteria – Cost

The estimated present worth costs for alternatives range from $143,000 million for Alternative 1N to $102.3 million for Alternative 6N, and from $0.14 million for Alternative 1S to $9.93 million for Alternative 4S. Costs for each alternative are presented with the descriptions of each alternative.

Modifying Criteria

TCEQ has been informed about the Preferred Remedy for the Site. Community acceptance will be determined through the Public Comment process based on comments received during the public comment period and the questions received at the public meeting.

Preferred Remedy

The Preferred Remedy for cleaning up the Site is Alternative 6N (Full Removal of Materials Exceeding Cleanup Levels, Institutional Controls, and Monitored Natural Recovery) and Alternative 4S (Removal and Offsite Disposal).

Based on the information available at this time, EPA believes that the Preferred Remedy is protective of human health and the environment, complies with ARARs, and provides the best balance of tradeoffs among the balancing criteria. It reduces risks within a reasonable time frame, provides for long-term reliability of the remedy, and minimizes reliance on institutional controls. It will achieve substantial risk reduction by removing the most contaminated materials, reduces remaining risks in the aquatic environment to the extent practicable through MNR, and manages the remaining risks to human health through institutional controls.

EPA considered several options for contaminated materials. EPA's preferred remedy includes full removal of contaminated materials above cleanup levels for the following reasons:

- The material is highly toxic and under baseline conditions may be highly mobile in a severe storm and therefore is considered a principal threat waste.
- The location of materials, either partially submerged within the San Jacinto River (northern impoundments) or on a small peninsula on the San Jacinto River (southern impoundment), result in limited ability to treat the waste in place without the threat of a release during the remedial action.
- The area has a high threat of repeated storm surges and flooding from hurricanes and tropical storms, which, if the material was left in place, could result in a release of hazardous substances.
- The history of armor cap maintenance required as a result of floods much less than the design 100-year flood.

For all of these factors, the Preferred Remedy provides greater permanence in comparison to other alternatives. Less costly alternatives rely on remedies that have a higher chance of failure by leaving principal threat waste source materials in the river, resulting in greater uncertainty as to their long-term effectiveness.

The Preferred Remedy can change in response to public comment or new information.

Glossary

Administrative Record – All documents which the EPA considered or relied upon in selecting the response action at a Superfund site, culminating in the Record of Decision for a Remedial Action.

Applicable, Relevant, and Appropriate Requirements (ARARs) – Generally, any Federal, State, or local requirements or regulations that would apply to a remedial action if it were not being conducted under CERCLA, or that while not strictly applicable, are relevant in the sense that they regulate similar situations or actions and are appropriate to be followed in implementing a particular remedial action.

Contaminants of Concern (COCs) - Those chemicals that are identified as a potential threat to human health or the environment, are evaluated further in the baseline risk assessment, and are identified in the RI/FS as needing to be addressed by the response action proposed in the Record of Decision.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) – Also known as Superfund. CERCLA is a Federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. Under CERCLA, the EPA can either pay for the site cleanup or take legal action to force parties responsible for site contamination to clean up the Site or pay back the Federal government for the cost of the cleanup.

Baseline Ecological Risk Assessment (BERA) – A study that determines and evaluates risks that site contamination poses to ecological receptors.

Engineering Controls – Instruments such as fencing or signage that are used to limit access to contaminated areas or areas that may pose a physical hazard.

Feasibility Study (FS) – A detailed evaluation of alternatives for cleaning up a site.

Five-Year Reviews – A review generally required by statute or program policy when hazardous substances remain at a site above levels which permit unrestricted use and unlimited exposure. Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. Reviews are performed five years after completion of the remedy construction at Superfund-financed sites, and are repeated every succeeding five years so long as future uses at a site remain restricted.

Hazard Index (HI) – In the baseline risk assessment, ration of the dose calculated for a receptor divided by the toxicity value. When the HI exceeds 1.0, a health risk or ecological risk is assumed to exist.

Human Health Risk Assessment (BHHRA) – Estimates the current and possible future risk if no action were taken to clean up a site. The EPA's Superfund risk assessors determine how threatening a hazardous waste site is to human health and the environment. They seek to determine a safe level for each potentially dangerous contaminant present (e.g., a level at which ill health effects are unlikely and the probability of cancer is very small). Living near a Superfund site doesn't automatically place a person at risk, that depends on the chemicals present and how a person is exposed to the chemical.

Implementability – One of EPA's primary balancing criteria addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Institutional Controls – Non-engineered instruments, such as administrative and/or legal controls, that help to minimize the potential for human exposure to contamination and/or protect the integrity of the remedy. Institutional controls work by limiting land or ground water use and/or providing information that helps modify or guide a person's action at a site. Some common examples include restrictive covenants, deed notices, or local ordinances.

Long-term Effectiveness and Permanence – One of EPA's primary balancing criteria that refers to the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

Monitored Natural Recovery (MNR) - A technology in which contaminant concentrations are monitored with no other remedial actions taken to address contamination. MNR assesses the natural attenuation of contaminants by physical, chemical, and biological processes.

Operable Unit - An operable unit is a discrete action that comprises an incremental step toward comprehensively addressing site contamination.

Nanograms per Kilogram (ng/kg) - Is a measurement of concentration used to measure how many nanograms of a contaminant are present in one kilogram of solid material (e.g., soil, sediment, tissue). One ng/kg is equal to 0.000001 milligrams per kilogram (mg/kg).

National Priorities List (NPL) – EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response.

Principal Threat Wastes - Those materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The EPA expects to use treatment when practical to address the principal threats posed by a site. The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to ground water, surface water, or air, or acts as a source for direct exposure.

Reasonable Maximum Exposure (RME) – The maximum exposure reasonably expected to occur in a population.

Reduction of Toxicity, Mobility, or Volume Through Treatment – One of EPA's primary balancing criteria that refers to the anticipated performance of the treatment technologies that may be included as part of the remedy.

Remedial Investigation (RI) – The collection and assessment of data to determine the nature and extent of contamination at a site.

Short-term Effectiveness – One of EPA's primary balancing criteria that addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

$TEQ_{DF,M}$ – 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity equivalent quotient calculated using toxicity equivalent factors for mammals

$TEQ_{P,M}$ – Dioxin-like PCB congener toxicity equivalent quotient calculated using toxicity equivalency factors for mammals.

SITE FIGURES